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# Simulates the 15 day mouse exposure study
# Data collected during and after exposure on 1st day
# and at end of exposure on day 5 and 15 (1 day nose-only)

#Set the working directory to where you downloaded the scripts
setwd(dirname(parent.frame(2)$ofile))

#Load libraries needed to run scenario
library(deSolve)

#Model path and name
mName <- "chloroprene.model"

#Load model inits file for the ode solver
source(paste0(mName,"_inits.R"))

#Load the states files
#Source(paste0(mPath,"states.R"))

#Load the model dll
dyn.load(paste0(mName,.Platform$dynlib.ext))

#Scenario specific values
tstart <- 0.0
tstop <- 443.0
times <- seq(tstart, tstop , by=0.01)

#Physiological parameters path
#load the parameters
source('./params/Female_Mouse_5.R')
source('./states.R')

#Timing variables for forcing functions
dstart <- tstart
dlength <- 6      #hours per day to expose
ddaysperwk <- 5   #days of week to expose
dexpend <- 19     #days of exposure
parms["TSTOP"] <- tstop

#Source forcing functions
#This loads the function forcing() in the namespace
source("forfunc.R")

#Scenario Specific Exposure
parms["CONC"]<- 12.3

parms <- initParms(parms)
Y <- initStates()

#Run ODE
print(system.time(
  out <- ode(Y, times, func = "derivs", parms = parms, method="vode",
  atol=1.0e-10, rtol=1.0e-8,

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        dllname = mName, initforc="initforc", forcings=forcings,
        initfunc = "initmod", nout = length(Outputs),
        outnames = Outputs)
    ))
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out1 <- as.data.frame(out,stringsAsFactors = F)
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#Scenario Specific Exposure
parms["CONC"]<- 32.0
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parms <- initParms(parms)
Y <- initStates()
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#Run ODE
print(system.time(
    out <- ode(Y, times, func = "derivs", parms = parms, method="vode",
                dllname = mName, initforc="initforc", forcings=forcings,
                initfunc = "initmod", nout = length(Outputs),
                outnames = Outputs)
))
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out2 <- as.data.frame(out,stringsAsFactors = F)
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#Scenario Specific Exposure
parms["CONC"]<- 80.0
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parms <- initParms(parms)
Y <- initStates()
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#Run ODE
print(system.time(
    out <- ode(Y, times, func = "derivs", parms = parms, method="vode",
                atol=1.0e-10, rtol=1.0e-8,
                dllname = mName, initforc="initforc", forcings=forcings,
                initfunc = "initmod", nout = length(Outputs),
                outnames = Outputs)
))
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out3 <- as.data.frame(out,stringsAsFactors = F)
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#Load the model dll
dyn.unload(paste0(mName,.Platform$dynlib.ext))
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#Read the dataset to be plotted
dataset1 <- read.csv("mouse13.csv",header = T,stringsAsFactors = F,
skip=1)
dataset2 <- read.csv("mouse32.csv",header = T,stringsAsFactors = F,
skip=1)
dataset3 <- read.csv("mouse90.csv",header = T,stringsAsFactors = F,
skip=1)
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par(mfrow=c(2,2))
plot(out1$time,out1$CVLUM, type = 'l', col='red',lwd = 2,
      xlab="TIME",ylab = expression(mu*"M"), main='Mouse Study 3 Week -
Day 1',
      xlim=c(0.0,7.0), ylim=c(0.0,15.0))
points(out2$CVLUM~out2$time,type = 'l',col='blue', lwd=2)
points(out3$CVLUM~out3$time,type = 'l',col='orange', lwd=2)
points(dataset1$time,dataset1$cart,type = 'p',col='red', pch=21,
bg='red')
points(dataset2$time,dataset2$cart,type = 'p',col='blue', pch=21,
bg='blue')
points(dataset3$time,dataset3$cart,type = 'p',col='orange', pch=21,
bg='orange')

plot(out1$time,out1$CVLUM, type = 'l', col='red',lwd = 2,
      xlab="TIME",ylab = expression(mu*"M"), main='Mouse Study 3 Week -
Day 5',
      xlim=c(96.0,106.0), ylim=c(0.0,15.0))
points(out2$CVLUM~out2$time,type = 'l',col='blue', lwd=2)
points(out3$CVLUM~out3$time,type = 'l',col='orange', lwd=2)
points(dataset1$time,dataset1$cart,type = 'p',col='red', pch=21,
bg='red')
points(dataset2$time,dataset2$cart,type = 'p',col='blue', pch=21,
bg='blue')
points(dataset3$time,dataset3$cart,type = 'p',col='orange', pch=21,
bg='orange')

plot(out1$time,out1$CVLUM, type = 'l', col='red',lwd = 2,
      xlab="TIME",ylab = expression(mu*"M"), main='Mouse Study 3 Week -
Day 19',
      xlim=c(432.0,442.0), ylim=c(0.0,15.0))
points(out2$CVLUM~out2$time,type = 'l',col='blue', lwd=2)
points(out3$CVLUM~out3$time,type = 'l',col='orange', lwd=2)
points(dataset1$time,dataset1$cart,type = 'p',col='red', pch=21,
bg='red')
points(dataset2$time,dataset2$cart,type = 'p',col='blue', pch=21,
bg='blue')
points(dataset3$time,dataset3$cart,type = 'p',col='orange', pch=21,
bg='orange')

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